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HORNER AND SHIFRIN INC ST LOUIS MO
NATIONAL DAM SAFETY PROGRAM, WEBER HILL TERRACE LAKE DAM (MO304--ETC(U))
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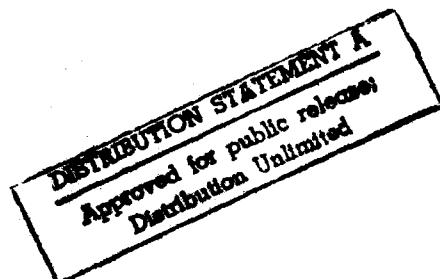
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WEBER HILL TERRACE LAKE DAM
JEFFERSON COUNTY, MISSOURI
MO 630449

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PHASE 1 INSPECTION REPORT NATIONAL DAM SAFETY PROGRAM



PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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SEPTEMBER 1978

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.		

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Weber Hill Terrace Lake Dam Phase I Inspection Report

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This report presents the results of field inspection and evaluation of the Weber Hill Terrace Lake Dam.

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

- 1) Spillway will not pass 50 percent of the Probable Maximum Flood.
- 2) Overtopping could result in dam failure.
- 3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY:

SIGNED

Chief, Engineering Division

29 SEP 1978

Date

APPROVED BY:

APPROVED

Colonel, CE, District Engineer

29 SEP 1978

Date

WEBER HILL TERRACE LAKE DAM
JEFFERSON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 30449

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Weber Hill Terrace Lake Dam (~~Inventory~~
Number MO-30449), Mississippi-Kaskaskia-St
Louis Basin, Jefferson County, Missouri.
Phase I Inspection Report.

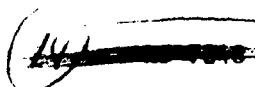
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U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS

11 SEPTEMBER 1978



PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Weber Hill Terrace Lake Dam
State Located: Missouri
County Located: Jefferson
Stream: Bear Creek
Date of Inspection: 19 July 1978

The Weber Hill Terrace Lake Dam was visually inspected by engineering personnel of the office of Horner & Shifrin, Inc., Consulting Engineers, St. Louis, Missouri. The purpose of the inspection was to assess the general condition of the dam with respect to safety and, based upon this inspection and available data, determine if the dam poses a hazard to human life or property.

Based on a visual inspection, the present general condition of the dam is considered to be satisfactory. The following deficiencies were noticed during the inspection and are considered to have an adverse effect on the overall safety and future operation of the dam:

1. A heavy cover of small- to medium-sized trees and brush exist on the downstream slope of the dam. The tree roots in time may provide a pathway for lake seepage. Some seepage, as is evidenced by cattails and wet ground, was noticed at the toe of the downstream slope at a point near the right abutment of the dam. The entire downstream slope of the dam should be more thoroughly examined when the brush and tree growth are removed.
2. The upstream face at the waterline has a grass cover, except at several locations where pieces of broken concrete have been placed, to protect it from erosion by wave action. A grass covered slope is not considered adequate to protect the slope from wave action. Erosion of the bank will reduce the cross section of the dam and could result in instability and/or overtopping. Raveling of the slope at the waterline was noticed across most of the dam.

3. The spillway outlet channel consists of a series of rock falls followed by a steep channel with a concrete lined invert and earth side slopes. This paved section terminates at the valley floor where the channel continues on a meandering course until it reaches the original stream. The concrete lined invert section of the spillway outlet channel is in poor condition, as is evidenced by extensive cracking, settlement, and missing portions of pavement. In addition, the concrete slab is undercut with the subgrade extensively eroded where visible. Since this lined earthen spillway section is located at the junction of the dam and abutment, loss of materials due to erosion in this area can reduce the stability of the dam.
4. A heavy growth of willows and brush exists on the section of the spillway outlet channel downstream of the concrete lined invert section. This growth will restrict channel flow and could allow spillway discharge to overflow the channel and flood the area adjacent to the dam downstream toe of slope. Saturation of the area adjacent to the dam may impair the stability of the dam.
5. The spillway control section is obstructed by vegetation, several small trees, and miscellaneous debris. These obstructions, although minor, will restrict flow at this section and consequently reduce lake outflow.

According to the criteria set forth in the recommended guidelines (see text), the spillway design flood for this dam, which is classified as intermediate in size and of high hazard potential, is specified to be the probable maximum flood (PMF). PMF is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. Results of a hydrologic/hydraulic analysis indicated the existing spillway to be inadequate to pass lake outflow resulting from a storm of PMF magnitude, or the outflow resulting from the 1 percent

chance (100-year frequency) flood. The existing spillway is capable of passing lake outflow corresponding to about 18 percent of the PMF. The length of the downstream damage zone, should failure of the dam occur, is estimated to be five miles.

A review of available data did not disclose that seepage and stability analyses of the dam were performed. This is considered a deficiency and should be rectified.

It is recommended that the Owner take the necessary action, without delay, to correct the safety defects and deficiencies reported herein.

Albert B. Becker, Jr.
Albert B. Becker, Jr.
P.E. Missouri E-9168



OVERVIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
WEBER HILL TERRACE LAKE DAM - ID NO. 30449

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

WEBER HILL TERRACE LAKE DAM
ID NO. 30449

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. National Dam Inspection Act, Public Law 92-367, dated 8 August 1972.

b. Purpose of Inspection. The purpose of this visual inspection was to make an assessment of the general condition of the dam with respect to safety and, based upon available data and this inspection, determine if the dam poses a hazard to human life or property.

c. Evaluation Criteria. This evaluation was performed in accordance with the "Phase I" investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Dams," dated May 1975.

1.2. DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances. The Weber Hill Terrace Lake Dam is an earthfill type embankment rising approximately 42 feet above the original stream bed. Lake level is governed by a spillway section cut into bedrock and located adjacent to the left (looking downstream) abutment. Below the spillway crest the outlet channel consists of a short (about 50 feet long) section of rock falls that leads to an earthen section with the invert paved with concrete. This paved section continues for approximately 150 feet until the channel reaches the valley floor below the downstream toe of dam. The channel then follows a meandering course for approximately 250 feet until it

joins the original stream, Bear Creek. At normal pool elevation the lake occupies approximately 11 acres. There are no drawdown facilities for dewatering the lake. A plan of the Weber Hill Terrace Subdivision showing the lake, dam, and spillway is shown on Plate 2.

b. Location. The dam and lake are located on Bear Creek, approximately 0.5 mile northeast of Weber Hill, Missouri, in Jefferson County, as shown on the Regional Vicinity Map, Plate 1. The dam is located in Section 26, Township 43 North, Range 4 East, approximately 0.5 mile southeast of the intersection of State Highway 30 and Gravois Road.

c. Size Classification. The size classification based on the height of the dam and storage capacity is categorized as intermediate. (Per Table 1, Recommended Guidelines for Safety Inspection of Dams.)

d. Hazard Classification. The Weber Hill Terrace Lake Dam, according to the St. Louis District, Corps of Engineers, has a high hazard potential, meaning that the dam is located where failure may cause loss of life, serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. The estimated flood damage zone, should failure of the dam occur, as determined by the St. Louis District, extends five miles downstream of the dam. Within the possible damage zone are 12 homes.

e. Ownership. The lake and dam are owned by the Weber Hill Terrace Community Association, Inc. The current president of the association, Mr. Gene Ufkes, resides at 5937 Spur Drive, House Springs, Missouri, 63051.

f. Purpose of Dam. The dam impounds water for the purpose of recreation for surrounding residential property owners who are members of the association.

g. Design and Construction History. The dam was constructed in 1957 by Mr. Walter H. Ficken, the developer of the Weber Hill Terrace Subdivision.

According to Mr. Ficken, no formal engineering or design data were employed in constructing the dam. A resident of the subdivision living adjacent to the lake reported that a leak located near the left abutment of the dam was sealed with grout sometime about 1963. In 1976, Mr. Ficken deeded the parkway property, which was occupied by the lake, dam, and spillway, to the Weber Hill Terrace Community Association, Inc.

h. Normal Operational Procedure. The lake level is unregulated.

1.3 PERTINENT DATA

a. Drainage Area. The area tributary to the lake is primarily residential. A recently completed 4-lane divided highway (Highway 30) crosses the watershed about 0.5 mile northwest of the dam. The watershed above the dam amounts to approximately 158 acres. The watershed area is outlined on Plate 1.

b. Discharge at Damsite.

- (1) Estimated known maximum flood at damsite ... 40+ cfs⁽¹⁾
- (2) Spillway capacity ... 220 cfs (estimated)

c. Elevation (ft above MSL). The top of a 2-inch steel pipe post located on the dam crest near the right abutment was assumed to be elevation 647. The ground elevation at the base of the post was based on the contours (10-foot intervals) shown on the 1954 House Springs, Missouri, Quadrangle Map, 7.5 minute series, photo revised 1968.

- (1) Top of dam ... 646.4 (min.)
- (2) Normal pool (spillway crest) ... 644.0
- (3) Streambed at centerline of dam ... 607.7+
- (4) Maximum tailwater ... Unknown

(1) Value computed for water surface at elevation 645.0 and based upon high lake level as indicated by a resident living adjacent to the lake.

d. Reservoir.

- (1) Length at normal pool (elevation 644.0) ... 1,150 ft.
- (2) Length at maximum pool (elevation 646.4) ... 1,200 ft.

e. Storage.

- (1) Normal pool ... 142 ac.ft.
- (2) Top of dam (incremental) ... 28 ac.ft.

f. Reservoir Surface.

- (1) Top of dam ... 12 acres
- (2) Normal pool ... 11 acres

g. Dam.

- (1) Type ... Earthfill
- (2) Length ... 580 ft.
- (3) Height ... 42 ft.
- (4) Top Width ... 12 ft.
- (5) Side Slopes
 - (a) Upstream ... 1v on 2.5h
 - (b) Downstream ... 1v on 2.6h
- (6) Cutoff ... Earthfill trench (per original owner)
- (7) Slope Protection
 - (a) Upstream ... Grass
 - (b) Downstream ... Grass

h. Spillway.

- (1) Crest elevation ... 644.0
- (2) Type ... Rock cut (at crest)
- (3) Width ... 30 feet (at elevation 646.4)

i. Outlet for Lake Drawdown ... None provided.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No engineering data relating to the design of the dam are known to exist.

2.2 CONSTRUCTION

No records relating to the construction of the dam are known to exist. According to Mr. Ficken, the developer of Weber Hill Terrace Subdivision and builder of the dam, a 10 foot wide keyway was excavated to bedrock along the centerline of the dam and backfilled with earth. Compaction was achieved by tracking the earth hauling equipment over the previously placed fill. No testing was done to determine density of fill placed in the embankment. The builder also reported that the spillway at the dam was cut into rock and the outlet channel invert was paved with concrete from the rock section to a point opposite the dam toe of slope at the left abutment.

2.3 OPERATION

The lake level is governed by an uncontrolled rock cut spillway. According to the builder, the dam has not been overtopped. Maintenance has consisted of mowing the grass and removing muskrats. The maximum known loading on the dam, according to a resident of the subdivision living adjacent to the lake since 1960, was a storm that produced a rise of about 12 inches above normal pool level. This resident also reported that a leak, located near the left abutment of the dam, was sealed with grout sometime about 1963 and since then no further seepage problems in this area have been experienced.

2.4 EVALUATION

a. Availability. Engineering data for assessing the design of the earthfill dam and spillway were unavailable.

b. Adequacy. No data available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the dam and spillway was made by Horner & Shifrin engineering personnel on 19 July 1978. Also inspected at that time was the area downstream of the dam, including the juncture of Bear Creek with Heads Creek and Heads Creek with the Big River, and the various downstream road crossings between the dam and Big River. Photographs of the dam taken at the time of the inspection are included on Pages A-1 through A-4 of the Appendix.

b. Dam. The visible portions of the upstream and downstream slopes (see Photos 1 and 2) of the dam appeared to be in satisfactory condition with the exception of some raveling of the upstream slope at the waterline. In several locations along the upstream slope eroded areas, that appeared to be caused by animal burrows, were backfilled with broken pieces of concrete debris. A heavy cover of small- to medium-sized trees and brush exists on almost the entire downstream slope. Some seepage, as is evidenced by cattails (see Photo 3) and wet ground, was noticed at the downstream toe near the right abutment. The source of the seepage appeared to be at the base of the large tree that appears to the left side of the photograph.

One medium-sized tree was present in the dam crest in the area adjacent to the spillway.

The elevation of the top of the dam, as determined by survey, was found to be from 1.0 to 1.3 feet lower across the central area of the dam than the top of dam in the area adjacent to the spillway. A profile of the dam crest centerline extending through the spillway section is shown on Plate 3.

c. Spillway. The crest of the rock cut spillway section (see Photo 4) was found to be in satisfactory condition although debris, high grass, and

several small trees indicated a lack of routine maintenance. A section of outlet channel located between the spillway crest and the valley floor is paved across the invert with concrete. This section (see Photos 5, 6, and 7), as evidenced by extensive cracking of the pavement, differential settlement of adjacent concrete slabs and missing portions of pavement, is in very poor condition. In addition, the paved invert is undercut with the subgrade extensively eroded in some visible areas. A heavy growth of willows and brush was present in the channel (see Photo 8) downstream of the concrete lined invert section.

d. Downstream Channel. The downstream channel, Bear Creek, is unimproved. The stream joins Heads Creek at a point approximately 3 miles below the dam. Heads Creek in turn joins Big River about 4 miles below the dam. Between the dam and Big River there are nine roadway stream crossings of various types and sizes.

3.2 EVALUATION

The deficiencies observed during the inspection and noted herein are not considered of major consequence to warrant immediate remedial action. The entire downstream slope should be re-examined to determine its condition after removal of the heavy cover of trees and brush. Care should be taken not to destroy the existing turf cover when this clearing work is performed.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The spillway is uncontrolled. The water surface level is governed by rainfall runoff, evaporation, seepage, and the capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM AND SPILLWAY

Based on the extensive cover of trees and vegetation on the downstream slope of the dam and the deteriorated condition of the spillway channel, it is apparent that these areas receive little attention. According to a resident living adjacent to the lake, the grass on the dam crest is mowed periodically. However, there is no established maintenance program for either the dam or spillway.

4.3 MAINTENANCE OF OUTLET OPERATING FACILITIES

No outlet operating facilities exist at this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEMS IN EFFECT

The inspection did not reveal the existence of a dam warning system.

4.5 EVALUATION

A poorly maintained dam is considered detrimental to the safety of the dam. It is recommended that maintenance of the dam and spillway be undertaken on a regular basis.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

- a. Design Data. Design data are not available.
- b. Experience Data. The drainage area and lake surface area were developed from the U.S.G.S. House Springs, Missouri, Quadrangle Map. The dimensions and proportions of the spillway and dam were developed from surveys made during the inspection.
- c. Visual Observations.
 - (1) The crest of the rock shelf overflow spillway section is in good condition. The concrete lined earth outlet channel section, located about 50 feet downstream of the spillway crest section, is in poor condition, with the concrete lining undercut and the subgrade badly eroded. Piping channels have developed under the concrete invert paving.
 - (2) Drawdown facilities are not provided to dewater the lake.
 - (3) The spillway and outlet channel are located at the left abutment of the dam. Spillway releases, within the limited capacity of the spillway section, will not endanger the integrity of the dam.
- d. Overtopping Potential. The spillway section is too small to pass the probable maximum flood, the 1/2 probable maximum flood, or the 1 percent chance (100-year frequency) flood without overtopping the dam. The results of a dam overtopping analysis are as follows:

<u>Ratio of PMF</u>	<u>Q - Peak Outflow (cfs)</u>	<u>Max. Lake Water Surface Elevation</u>	<u>Maximum Depth of Flow Over Dam (Elev. 646.4)</u>	<u>Duration of Overtopping of Dam (Hours)</u>
0.18	220	646.4	0	0
0.5	1,460	647.5	1.1	3.8
1.0	3,000	648.1	1.7	6.2
100-Year Flood	250	646.5	0.1	0.3

The flow safely passing the spillway just prior to overtopping amounts to about 220 cfs, which is equivalent to the outflow from about 18 percent of the probable maximum flood and less than the outflow from the 1 percent chance (100-year frequency) flood.

Procedures and data for determining the probable maximum flood, the 100-year frequency flood and the discharge rating curve for flow over the spillway and the dam crest are presented on Pages B-1 and B-2 of the Appendix. A listing of the HEC-1DB input data is shown on Pages B-3 thru B-5 of the Appendix.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

- a. Visual Observations. Visual observations which adversely affect the structural stability of the dam are discussed in Section 3, paragraph 3.1b.
- b. Design and Construction Data. No design or construction data relating to the structural stability of the dam are known to exist.
- c. Operating Records. No appurtenant structures or facilities requiring operation exist at this dam. According to the owner, no records have been kept of lake level, spillway discharge, dam settlement, or seepage.
- d. Post Construction Changes. According to the present and former owners, except for grouting to reduce seepage near the left dam abutment, post construction changes were not made which will affect the structural stability of the dam.
- e. Seismic Stability. Since the dam is located within a Zone II seismic probability area, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. A hydraulic analysis indicated the rock spillway to be capable of passing lake outflow of about 220 cfs without the level of the lake exceeding the low point in the top of the dam. A hydrologic analysis of the lake watershed area, as discussed in Section 5, paragraph 5.1d, indicated that for a storm runoff of probable maximum flood magnitude, the lake outflow would be on the order of 3,080 cfs, and that for the 1 percent chance (100-year frequency) flood, the lake outflow would be about 250 cfs.

Several items were noticed during the visual inspection that adversely affect the safety of the dam. These items, which exist on the downstream slope, are seepage, trees, and dense brush. The extent of the effects of these items can be better assessed after the trees and brush are removed. The deteriorated condition of the paved invert section of the spillway outlet channel and particularly the erosion of the subgrade for this section are also of concern. It is possible that continued erosion of the spillway channel can, in time, effect the stability of the dam since the channel alignment closely follows the slope line intersection at the left abutment.

No stability or seepage analyses of the dam or hydraulic analysis of the spillway are known to exist.

b. Adequacy of Information. Due to the lack of engineering and construction data, the assessments reported herein were based on external conditions as determined during the visual inspection. The assessment on the hydrology of the watershed and capacity of the spillway was based on a hydrologic/hydraulic study as indicated in Section 5.

c. Urgency. The items concerning the safety of the dam noted in paragraph 7.1a and the remedial measures recommended in paragraph 7.2 should be accomplished in the near future.

d. Necessity for Phase II. Based on the results of the Phase I inspection, a Phase II investigation is not recommended.

e. Seismic Stability. Since the dam is located within a Zone II seismic probability area, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

7.2 REMEDIAL MEASURES

a. Recommendations. The following actions are recommended:

(1) Spillway size and/or height of dam should be increased to pass lake outflow resulting from a storm of probably maximum flood magnitude.

(2) Obtain the necessary soil data and perform stability and seepage analyses of the dam in order to determine the structural stability of the dam for all operational conditions.

b. O & M Maintenance and Procedures. The following O & M maintenance and procedures are recommended:

(1) Remove the trees and brush from the downstream face and crest of the dam. Tree roots provide a passageway for seepage that can lead to a piping condition and potential failure. The existing turf cover should be restored if destroyed or missing. Maintain the turf cover on the slope at a height that will not hinder inspection of the slope.

(2) Once the downstream slope is cleared of trees and brush, it should be thoroughly checked for seepage, erosion and other signs of instability. If excessive seepage flows are observed or sloughing noted, the dam should be investigated by an engineer experienced in design and construction of dams.

(3) Restore the subgrade of the concrete lined invert section of the spillway. Provide some means (such as a cutoff wall at the upstream end and sealing of paving joints, cracks, and holes) of preventing spillway flow from undercutting the lined invert in order to prevent future erosion of the restored section.

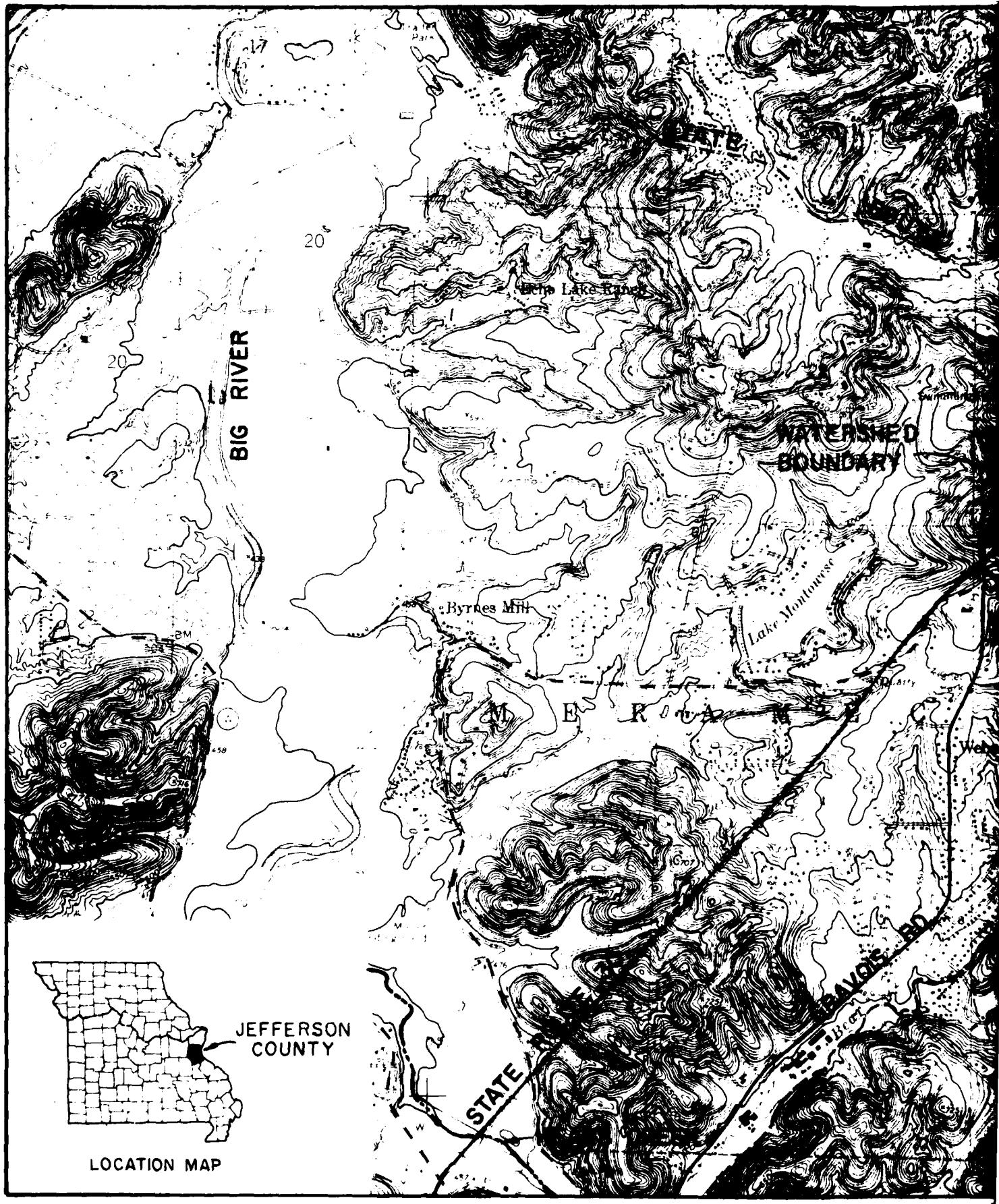
(4) Remove trees and brush from spillway channel section below dam in order to allow spillway flow to reach the downstream channel unrestricted. Restricting spillway discharges can result in flooding of the area adjacent to the toe of dam and cause conditions detrimental to the stability of the embankment.

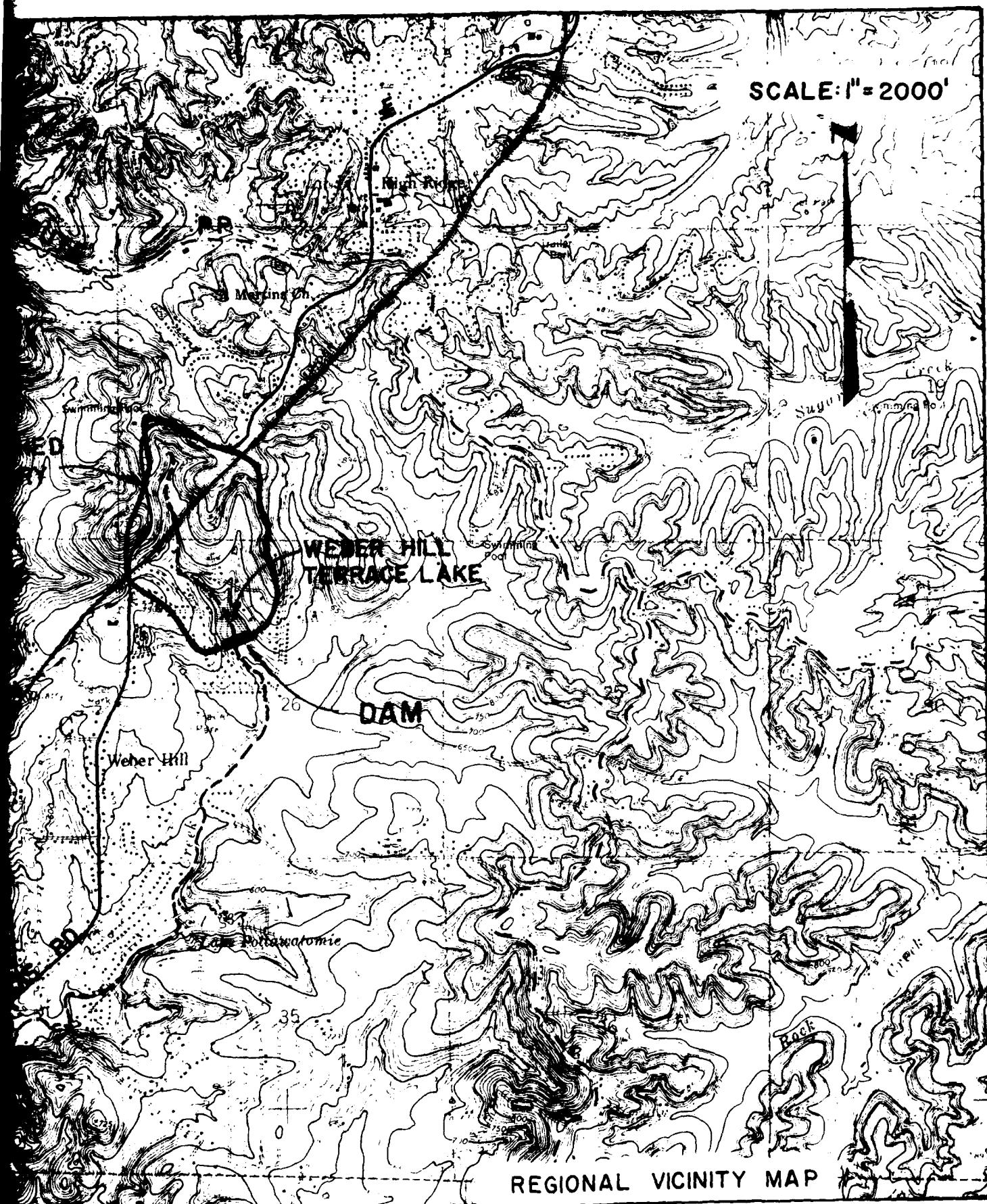
(5) Provide some form of slope protection for the upstream face of the dam below and above the normal water line in order to prevent erosion by wave action.

(6) Check the dam for the presence of animal burrows both at and below the upstream water level. Any burrowing animals discovered should be exterminated and their burrows completely backfilled.

(7) Provide maintenance of all areas of the dam and spillway on a regularly scheduled basis in order to insure that these features are maintained in satisfactory condition.

(8) A detailed inspection of the dam should be instituted on a regular basis by an engineer experienced in the design and construction of dams. It is also recommended, for future reference, that records be kept of all inspections and remedial measures.





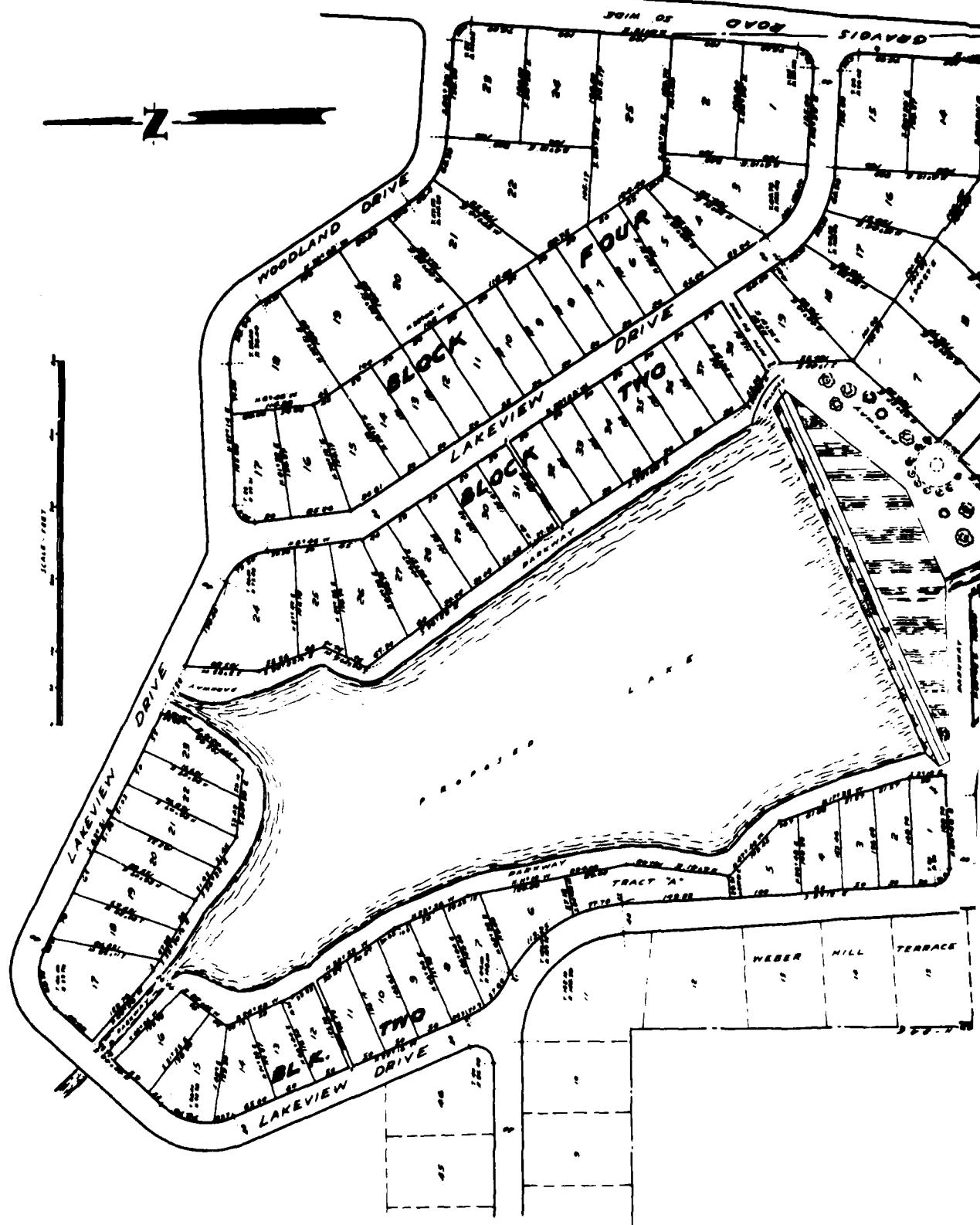
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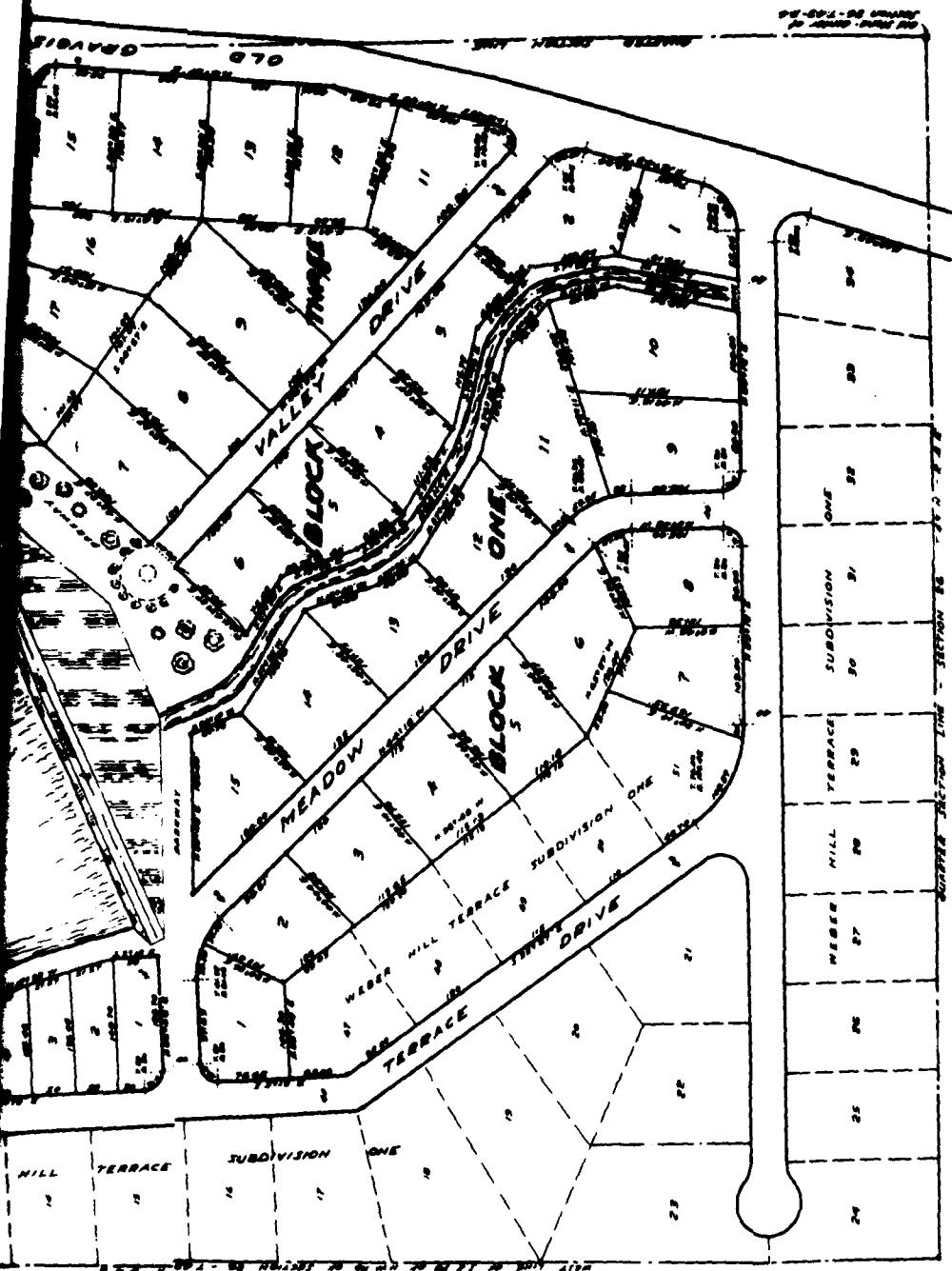
PLATE I

SUBDIVISION TWO

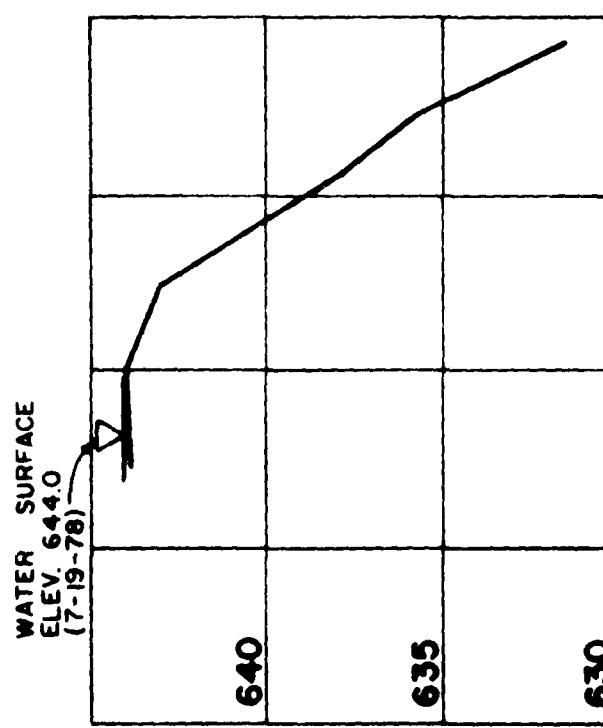
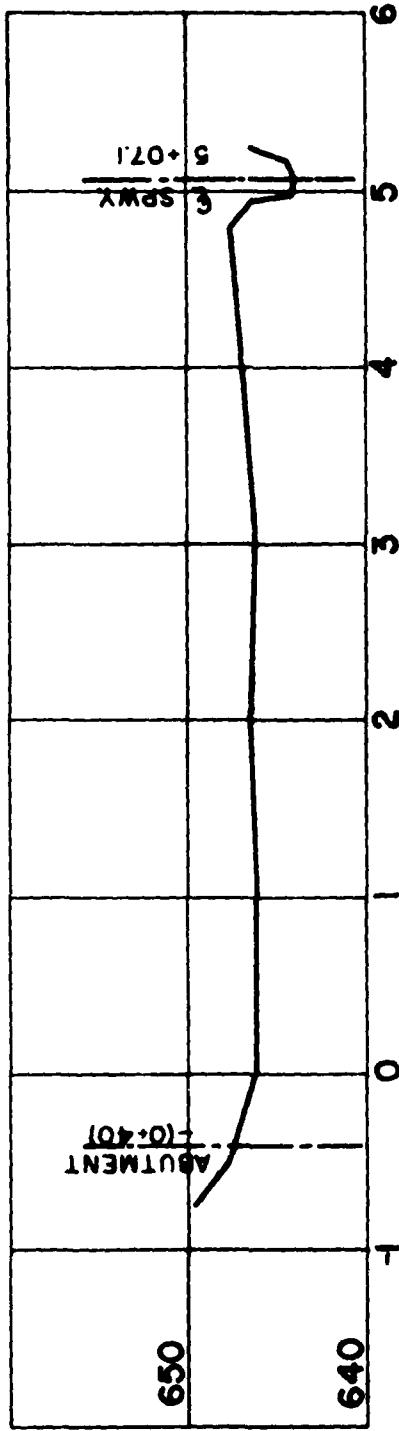
WEBER HILL TERRACE

SITUATE IN SECTION 28 - TWP. 43 N. - R. 4 E.
JEFFERSON COUNTY, MISSOURI





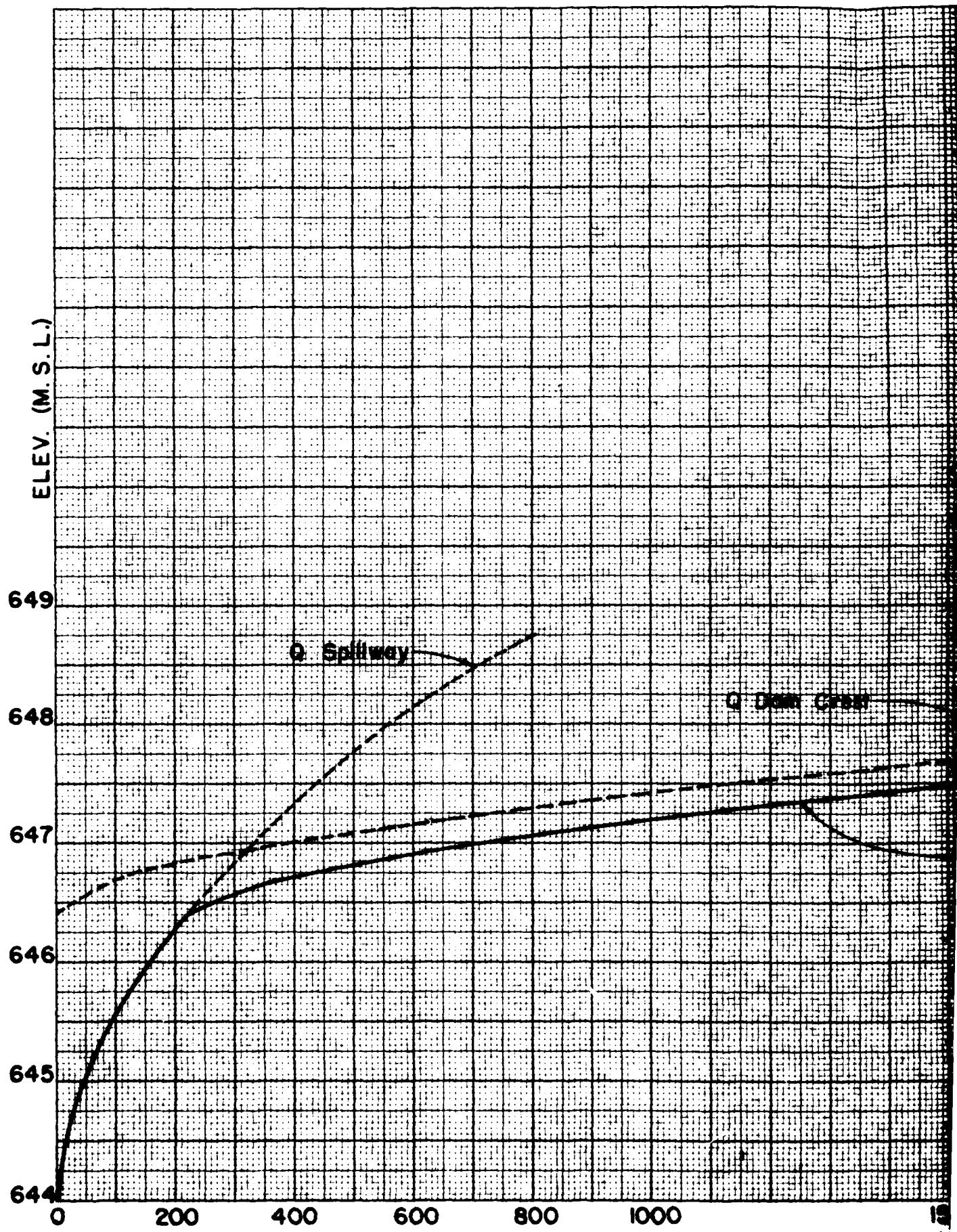
SUBDIVISION PLAT



PROFILE SPILLWAY E

SCALES: 1"=5' V, 1"=50' H.

WEBER HILL TERRACE LAKE
DAM & SPILLWAY PROFILES
Homer & Shifrin, Inc. July 1978



1500 2000 2500 3000

Q (cfs)

2

2000

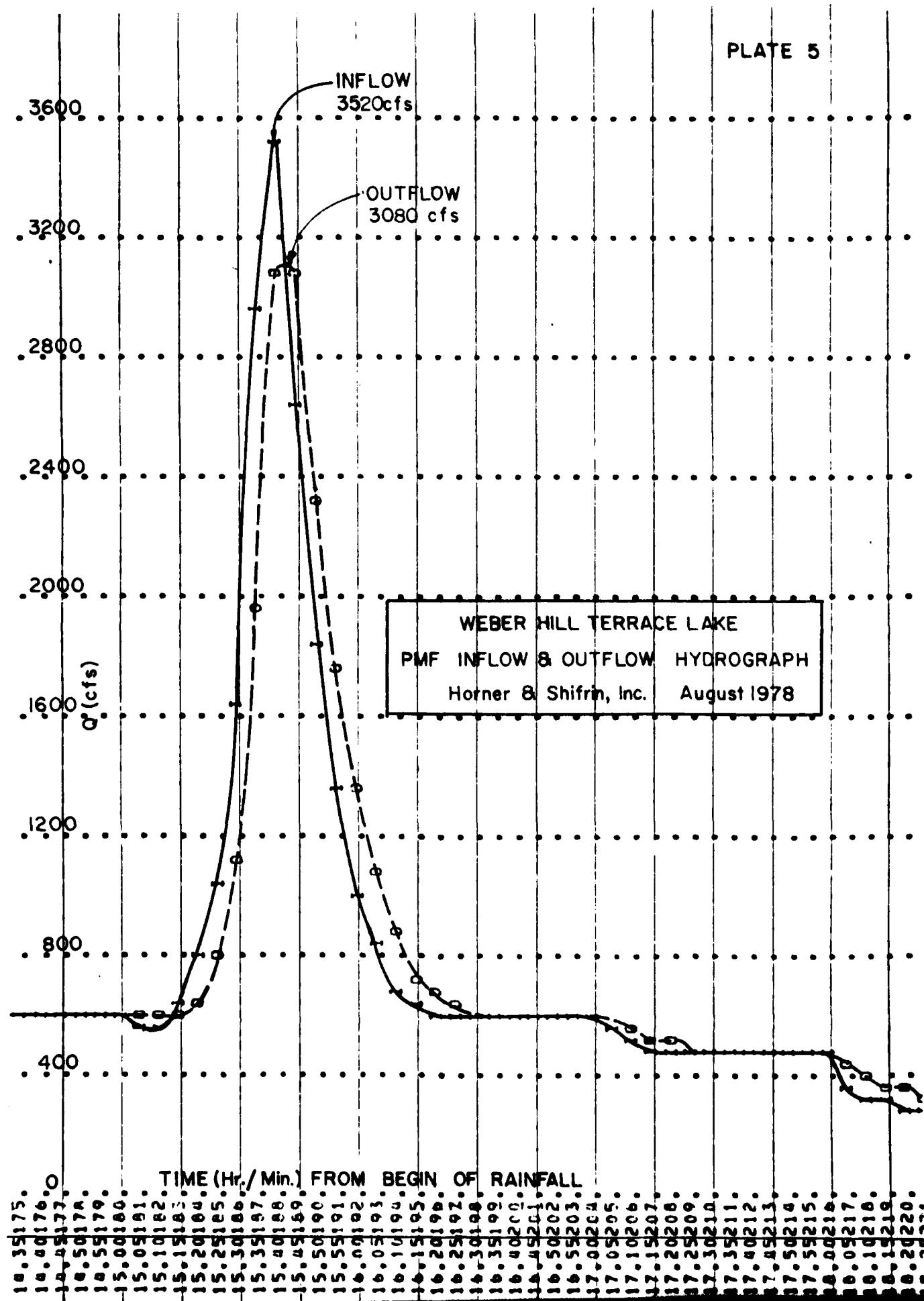
2500

3000

PLATE 4

DESIGN STORM RATING CURVE
1500 2000 2500 3000

PLATE 5



APPENDIX



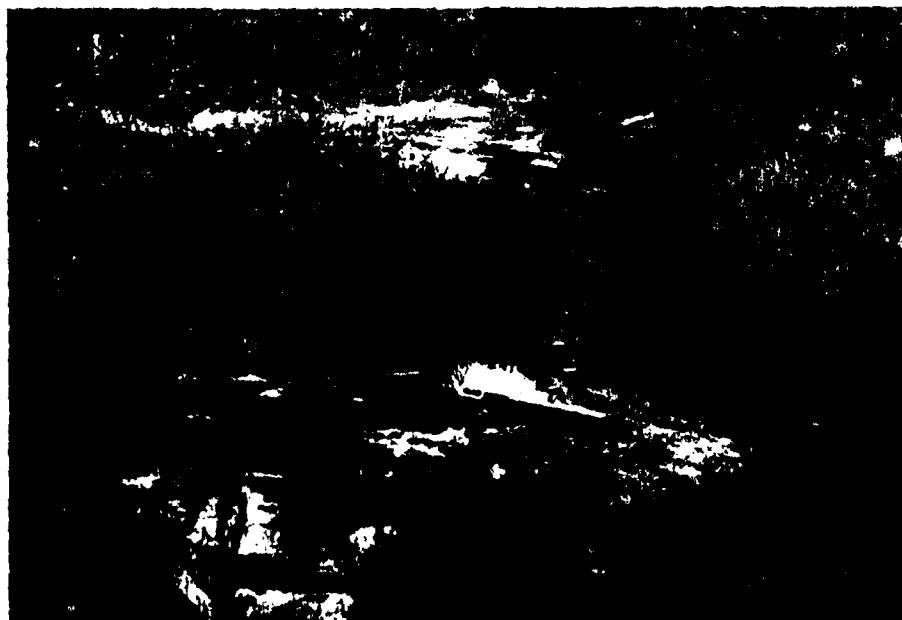
NO. 1: UPSTREAM FACE OF DAM



NO. 2: DOWNSTREAM FACE OF DAM



NO. 3: CATTAILS AT JOE OF DAM



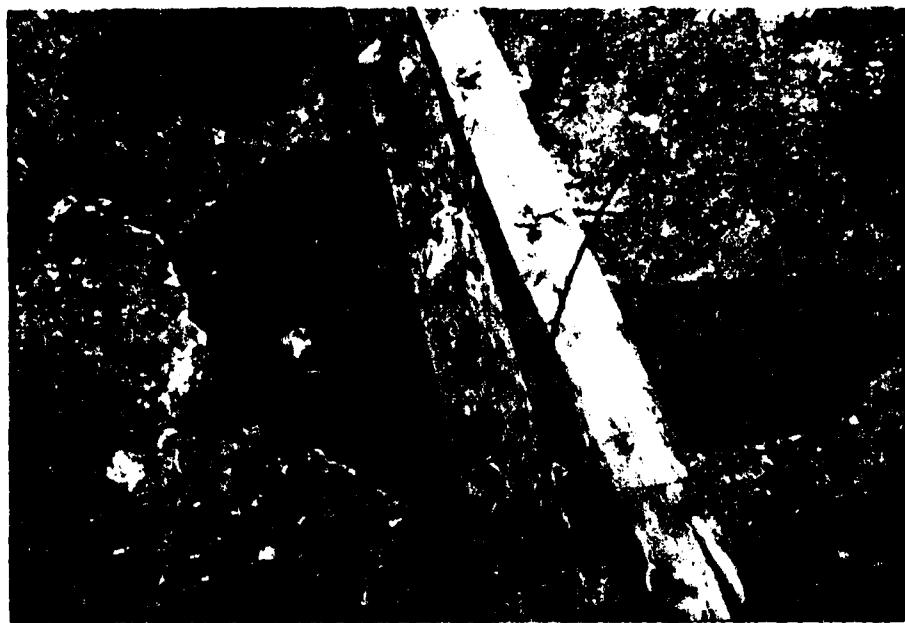
NO. 4: SPILLWAY CREST



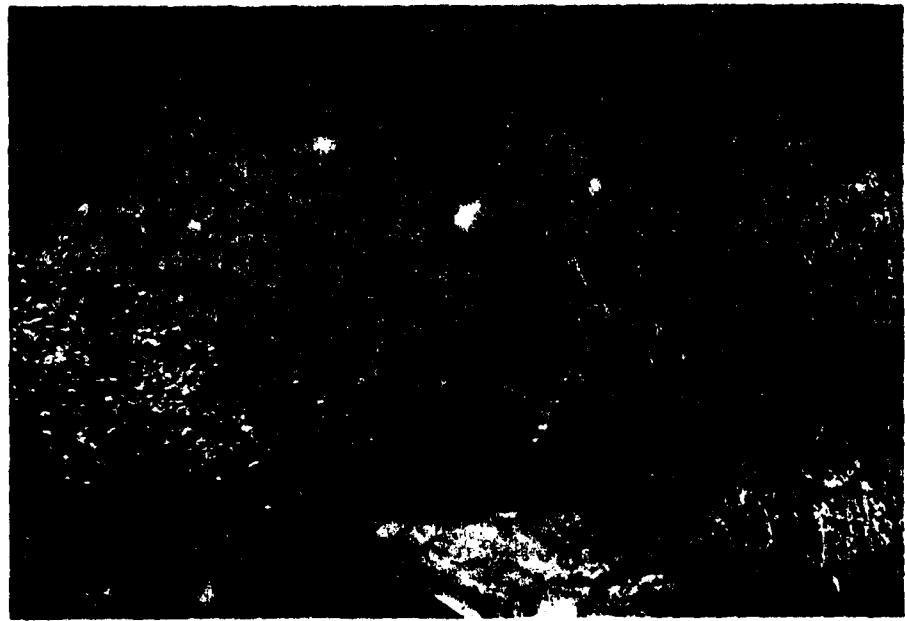
NO. 5: UPSTREAM END OF PAVED SPILLWAY INVERT



NO. 6: DOWNSTREAM END OF PAVED SPILLWAY INVERT



NO. 7: HOLE IN PAVED INVERT



NO. 8: SPILLWAY CHANNEL AT VALLEY

HYDROLOGIC COMPUTATIONS

1. The HEC-1 Dam Safety Version (July 1978) program was used to develop inflow and outflow hydrographs and dam overtopping analyses, with hydrologic inputs as follows:

a. Probable maximum precipitation (200 sq. mile, 24-hour value equals 25.6 inches) from Hydrometeorological Report No. 33. One hundred year frequency (point source precipitation, 24-hour value equals 7.23 inches) from U.S. Weather Bureau Technical Paper No. 40.

b. Drainage area = 0.25 square miles
= 158 acres

c. SCS parameters

Lag time = 0.11 hours
Soil type CN = 80

2. The spillway section consists of a broad-crested, approximately V-shaped rock section for which conventional weir formulas do not apply.

Spillway release rates were determined as follows:

- (1) Spillway crest section properties (area, a and top width, t) were computed for various depths, d.
- (2) It was assumed that flow leaving the spillway crest would occur at critical depth. Flow at critical depth (Q_c) was computed as $Q_c = \frac{(a^3 g)^{0.5}}{t}$ for the various depth, d.

Corresponding velocities (v_c) and velocity heads (H_{vc}) were determined using conventional formulas.

(3) Static lake levels corresponding to the various Q_c values passing over the spillway were computed as critical depths plus critical velocity head ($d_c + H_{vc}$), and the relationship between lake level and spillway discharge was thus obtained. The procedure neglects the minor insignificant friction losses across the length of the spillway.

3. The profile of the dam crest is irregular and flow over the dam crest cannot be determined by conventional weir formulas. Flow quantities overtopping the dam crest were computed as described in the preceding paragraph and corresponding flow over the dam and spillway for given elevations were added to obtain the combined outflow rating curve for the dam and spillway. This rating curve is shown on Plate 4. The inflow and outflow hydrographs for the PMF are shown on Plate 5.

FLOOD HYDROGRAPH PACKAGE (HEC-1)
CAN SAFETY VERSION 3 JULY 1978
LAST MODIFICATION 3 AUG 78

FLYING HYDROGRAPH PACKAGE (MFC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 3 AUG 78

**ANALYSIS OF DAM OVERTOPPING USING 100 YR
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF NEVER HILL TERRACE DAM 100 YR
100 YR ROUTED THRU RESERVOIR**

41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441																																							
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441

51	Y5	3560	11.0	13.9	18.4
52	SA	0			660
53	SE	605	644	650	
54	SS	644.0			
55	SD	646.4			
56	K	99			

DAT
ILM